SOIL AND GROUND WATER ASSESSMENT
OLD SALISBURY ROAD SITE
WINSTON-SALEM, NORTH CAROLINA

Prepared For

North Carolina Department of Transportation
Winston-Salem, North Carolina

Prepared By

Aquaterra, Inc.
Raleigh, North Carolina

December 31, 1987

Aquaterra, Inc.

AQUATERRA
Aquaterra, Inc. • P.O. Box 50328 • Raleigh, NC 27650 • 919-839-0199

December 31, 1987

1-27-88
Loretta Williams
DOT - 761-2461
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North Carolina Department of Transportation
P.O. Box 5436
Winston-Salem, NC 27113-5436

Attention: Mr. Stanley Morgan

Subject: NCDOT Site Soil and Ground Water Assessment
Old Salisbury Road, Winston-Salem, North Carolina
Aquaterra Job #200-87-123

Dear Mr. Morgan:

This letter report includes a description of the soil assessment and related field activities conducted at the North Carolina Department of Transportation (NCDOT) site on Old Salisbury Road in Winston-Salem, North Carolina, as shown on Figure 1. Herein is contained a narrative of the field investigation activities conducted for the soil and ground water assessment as well as our conclusions and recommendations.

1.0 Soil Assessment

On October 1, 1987, a geologist from Aquaterra, Inc. was mobilized to the site for reconnaissance concerning an underground tank removal and soil assessment. The excavated tank had an estimated capacity of 10,000 gallons and had been removed in late September by representatives of Four Seasons Industrial Services, Inc. The tank, which had contained diesel fuel, was in good condition and showed no visual evidence of leakage. However, staining on the top and sides of the tank (i.e., the area of the tank which had been located under the discharge pump) indicated that either the pump or discharge lines had possible past leakage.

The pit created by the excavation of the tank is shown in Figure 2. Soils were removed from the pit to a depth of approximately 11 feet, which reflected the bottom elevation of the tank. A soil excavation log is shown in Attachment A. During excavation, water seeped into the pit bottom suggesting that this depth is possibly below the depth to water table at the site. Soils excavated from above and beside the tank were stockpiled to the north of the pit in Stockpiles #1, 2 and 3, as shown in Figure 3.

To ensure that the soils remaining in the pit were in compliance with clean-up levels recommended in the North Carolina Department of Natural Resources and Community Development (NRCD) "Guidelines for Remedial Action Concerning Contaminated Soil and Rock Material Removed From Areas of Hydrocarbon Contamination" (shown in Attachment B), soil samples were collected for analysis with an Organic Vapor Analyzer (OVA) for total volatilized hydrocarbons. Samples were

collected from the pit stations A through H, shown on Figure 2. Each sample was collected, placed in a clean glass jar (half-full) and allowed approximately 10 minutes to equilibrate prior to reading with the OVA. All OVA readings of soil samples collected from the pit are shown on Table 1.

The OVA results indicated that a majority of the soil had been removed to below levels of 10 ppm total volatilized hydrocarbons from stations D, E, F, G and H. These stations are located at the western portion of the pit and are the stations furthest from the former pump location. Some of the soil samples from these stations did yield OVA readings of greater than 10 ppm. However, all such readings from stations D through H came from soils located either at or directly above the ground water. Therefore, it was decided that those soils would be addressed as part of the ground water assessment.

Soil OVA readings in excess of 10 ppm from stations B and C indicated that additional soil needed to be excavated from the area east of these two stations. Based on the OVA readings, the pit was extended eastward as shown on Figure 3. Eventually, four new sampling stations, K, L, M and N, were added and were sampled consistent with the methodology mentioned previously. All of the OVA readings are shown in Table 1. When soils yielding OVA readings below 10 ppm were reached in the four new stations, two samples (K and L) were placed in clean glass jars for laboratory analysis.

All samples were labeled with a tag identifying sample number, date, time, location, method of collection, analysis to be conducted and remarks. The samples were kept in a cooler, chilled to approximately 4^{o}C and transported to the analytical laboratory utilizing EPA approved chain-of-custody procedures. All soil samples were analyzed for total petroleum hydrocarbons according to EPA Method 3550 with gas chromatographic analysis according to EPA Method 8020 with results shown in Table 2 and Attachment C.

The results of the laboratory analysis indicated that additional soil needed to be excavated from the area west of station K (or south of station B). As shown on Figure 3, soil was excavated west of station K into the southern part of station A. At this point, the soil excavation was stopped because the soils producing the high OVA readings were those from directly above the water table. A soil sample for laboratory analysis was collected from the west pit wall soils in Station A (I). This sample was collected following the sampling techniques described above and analyzed for total petroleum hydrocarbons, with results shown in Table 2 and Attachment B.

2.0 Ground Water Assessment

Based upon the elevated OVA readings in the vicinity of the ground water and a meeting held with Ms. Brenda Smith of NRCD, it was decided that ground water monitor wells would be required. A total of two temporary wells were installed in the pit by advancing a decontaminated hand auger and placing a PVC screen in the boring. The first temporary well (TW-1) was installed in the western part of Station B, as shown in Figure 4. Two ground water samples were collected using decontaminated bailer and placed in two decontaminated 500 ml glass jars. Both samples were labeled with a tag identifying sample number, date, time, location, method of collection, analysis to be conducted, samplers and remarks. The samples were kept in a cooler, chilled to approximately 4^{o}C and transported to the analytical laboratory utilizing EPA approved chain-of-custody procedures. The samples were analyzed for total petroleum hydrocarbons by gas chromatograph, with results shown in Table 3 and Attachment D.

Upon reviewing the analytical results and as requested by NRCD, a second temporary well (TW-2) was installed on October 26, 1987, in the southern part of Station A, as shown in Figure 4. Two ground water samples were collected following the sampling procedures described above. The first sample was analyzed for total petroleum hydrocarbons by gas chromatograph, with results shown in Table 3 and Attachment D. The second sample was analyzed by EPA Method 625, with results shown in Table 4 and Attachment D.

2.0 Soil Remediation

As stated above, the soils that were excavated from above and beside the underground tank prior to the tank excavation were placed in three stockpiles just north of the pit, as shown in Figure 3. Soil samples were collected from these three stockpiles for analysis with the OVA utilizing the methodology mentioned previously. The results of the OVA readings are shown on Table 5. These results indicated that the soils in Stockpiles 2 and 3 were in compliance with the NRCD guidelines of 10 ppm total volatilized hydrocarbons. Upon receiving permission from the NRCD, these soils were used to partially backfill the pit. The OVA results from Stockpile #1 samples indicated that these soils needed to be aerated prior to disposal.

The soils excavated from the pit based on OVA readings were placed in Stockpile #4, which is located north of the building, as shown in Figure 3. The soils from Stockpile #1 were added to those in Stockpile #4, forming Stockpile #5, shown in Figure 4. Together these soils were spread out on plastic to a thickness ranging from 0.5 feet to 1.0 feet. There was enough plastic remaining to cover the soil in the event of inclement weather.

These soils were allowed to aerate for approximately 4 weeks at which time soil samples were collected from the stockpile Stations A through N, shown on Figure 4, for analysis with an OVA. The results of these readings are shown on Table 5. These results indicated that, with the exception of Station A, the soil from all of the sample stations were in compliance with NRCD guidelines. However, since the soil from Station I was at the upper end of acceptability (10 ppm), it was decided that both Stations A and I should remain for additional aeration. Based on field reconnaissance, it was decided stations B and H were also to remain for additional aeration.

A composite soil sample was collected from Stations C, D, E, F, G, J, K, L, M and N for laboratory analysis. This sample was collected using the sampling procedure described above and analyzed for total petroleum hydrocarbons. The results of the analysis of 86.3 mg/Kg total petroleum hydrocarbons is shown in Table 6 and Attachment E. The laboratory results indicated that the soils from Stations C, D, E, F, G, J, K, L, M and N were in compliance with the NRCD guidelines of 100 mg/Kg total petroleum hydrocarbons.

Approximately two weeks later on November 12, 1987, a composite soil sample was collected from Stockpile #5 Stations A, B, H and I for laboratory analysis. This sample was collected observing the procedure described above and analyzed for total petroleum hydrocarbons. The laboratory results are shown on Table 6 and Attachment E. The results of 1480 mg/Kg total petroleum hydrocarbons indicated that additional aeration would be required for the soils in Stations A, B, H and I. On December 16, 1987, after four additional weeks of aeration, a composite soil sample was collected from these four stations and submitted to a laboratory. The sample was collected using the above procedures with results pending.

3.0 Conclusions and Recommendations

Based upon the laboratory results of the soil and water samples collected from and below the pit, we have concluded that:

- o no further excavation of the pit is required; and
- o ground water under the site is in compliance with existing state regulations.

After the laboratory results of the Stockpile #5 Stations C, D, E, F, G, J, K, L, M and N composite sample had returned, and with the approval of the Winston-Salem NRCD representatives (telephone conversation with Steve Kay and Brenda Smith), the soils from those stations were used to finish backfilling the pit.

The Stockpile #5 Stations A, B, H and I soils are still aerating and a composite sample is presently being analyzed. Should the results of this sample be less than 100 mg/Kg total petroleum hydrocarbons, it would be our recommendation that, since the pit area is going to be paved over once the highway is built, these soils be disposed of either on or near the former pit since the presence of the pavement would limit the amount of recharge through these soils. If the results of the sample are again greater than 100 mg/Kg total petroleum hydrocarbons, we would then recommend in-situ bioreclamation to remediate these soils.

If has been a pleasure working with you on this project. If you have any questions, please do not hesitate to contact us.

Sincerely,

AQUATERRA, INC.

Patrick S. Baker

Patrick S. Baker
Project Geologist

Phillip L. Rahn

Phillip L. Rahn, P.G.
Senior Hydrogeologist

cc: Bill Moon

R144-87

TABLES

TABLE 1

Former Underground Storage Tank Pit
Soil OVA Readings
NCDOT/Old Salisbury Rd. Site
Winston-Salem, North Carolina
Aquaterra Job #200-87-123

Sample Station	Sample Location	Date	Sample Depth (ft.)	OVA Reading (ppm)
A	South Pit Wall	10-1-87	2-4	0.3
A	South Pit Wall	10-1-87	6-8	0.2
A	South Pit Wall	10-1-87	10-12	100.0
A	Pit Floor	10-1-87	12-13	86.0
A	West Pit Wall	10-8-87	2-4	0.3
A	West Pit Wall	10-8-87	6-8	3.4
A	West Pit Wall	10-8-87	10-12	67.0
B	South Pit Wall	10-1-87	2-4	8.7
B	South Pit Wall	10-1-87	6-8	0.1
B	South Pit Wall	10-1-87	10-12	26.0
B	Pit Floor	10-1-87	12-13	96.0
B	West Pit Wall	10-8-87	2-4	NR
B	West Pit Wall	10-8-87	6-8	1.0
B	West Pit Wall	10-8-87	10-12	50.0
B	West Pit Wall	10-8-87	2-4	NR
B	West Pit Wall	10-8-87	6-8	1.5
B	West Pit Wall	10-8-87	10-12	11.0
B	West Pit Wall	10-8-87	2-4	1.2
B	West Pit Wall	10-8-87	6-8	2.6
B	West Pit Wall	10-8-87	10-12	100.0
C	North Pit Wall	10-1-87	2-4	0.7
C	North Pit Wall	10-1-87	6-8	2.6
C	North Pit Wall	10-1-87	10-12	36.0
C	Pit Floor	10-1-87	12-13	32.0
D	North Pit Wall	10-1-87	2-4	5.0
D	North Pit Wall	10-1-87	6-8	19.0
D	North Pit Wall	10-1-87	10-12	1.0
D	Pit Floor	10-1-87	12-13	3.4
E	North Pit Wall	10-1-87	2-4	0.4
E	North Pit Wall	10-1-87	6-8	1.2
E	North Pit Wall	10-1-87	10-12	4.5
E	Pit Floor	10-1-87	12-13	6.6
F	West Pit Wall	10-1-87	2-4	NR
F	West Pit Wall	10-1-87	6-8	4.0
F	West Pit Wall	10-1-87	10-12	2.2

NR = No Reading Detected (< 0.1 ppm)

TABLE 1 (CONT'.)

Sample Station	Sample Location	Date	Sample Depth (ft.)	OVA Reading (ppm)
G	West Pit Wall	10-1-87	2-4	0.1
G	West Pit Wall	10-1-87	6-8	0.1
G	West Pit Wall	10-1-87	10-12	0.1
H	South Pit Wall	10-1-87	2-4	0.1
H	South Pit Wall	10-1-87	6-8	0.2
H	South Pit Wall	10-1-87	10-12	0.1
H	Pit Floor	10-1-87	12-13	125.0
I	Pit Floor	10-1-87	0-2	120.0
I	Pit Floor	10-1-87	3-4	18.0
I	Pit Floor	10-1-87	9-10	29.0
I	North Pit Wall	10-1-87	2-4	18.0
I	North Pit Wall	10-2-87	1-3	0.3
I	North Pit Wall	10-8-87	4-6	2.0
I	North Pit Wall	10-8-87	8-10	8.1
I	East Pit Wall	10-1-87	1-3	20.0
I	East Pit Wall	10-1-87	6-8	48.0
J	Pit Floor	10-1-87	0-2	30.0
J	Pit Floor	10-1-87	3-4	8.0
J	Pit Floor	10-1-87	9-10	4.0
J	East Pit Wall	10-1-87	1-3	18.0
J	East Pit Wall	10-1-87	2-4	33.0
J	East Pit Wall	10-1-87	6-8	3.0
J	East Pit Wall	10-2-87	1-3	0.1
J	East Pit Wall	10-8-87	4-6	0.1
J	East Pit Wall	10-8-87	8-10	2.5
J	North Pit Wall	10-1-87	1-3	10.0
J	North Pit Wall	10-1-87	6-8	10.0
J	North Pit Wall	10-2-87	1-3	0.2
J	North Pit Wall	10-8-87	4-6	5.9
J	North Pit Wall	10-8-87	8-10	5.0
K	Pit Floor	10-1-87	0-2	40.0
K	Pit Floor	10-1-87	4-5	38.0
K	Pit Floor	10-1-87	9-10	6.0
K	Pit Floor	10-2-87	11-12	8.3
K	South Pit Wall	10-1-87	1-3	230.0
K	South Pit Wall	10-1-87	2-4	10.0
K	South Pit Wall	10-1-87	6-8	13.0
K	South Pit Wall	10-2-87	2-3	35.0
K	South Pit Wall	10-5-87	1-2	6.8
K	South Pit Wall	10-5-87	3-4	1.1

TABLE 1 (CONT'.)

Sample Station	Sample Location	Date	Sample Depth (ft.)	OVA Reading (ppm)
K	South Pit Wall	10-8-87	4-6	14.0
K	South Pit Wall	10-8-87	4-6	1.2
K	South Pit Wall	10-8-87	8-10	1.5
K	South Pit Wall	10-8-87	8-10	1.7
K	West Pit Wall	10-8-87	2-4	0.2
K	West Pit Wall	10-8-87	4-6	90.0
K	West Pit Wall	10-8-87	6-8	7.9
K	West Pit Wall	10-8-87	8-10	100.0
K	West Pit Wall	10-8-87	10-12	68.0
L	Pit Floor	10-2-87	11-12	37.0
L	South Pit Wall	10-2-87	2-3	15.0
L	South Pit Wall	10-5-87	1-2	1.3
L	South Pit Wall	10-5-87	3-4	0.7
L	South Pit Wall	10-8-87	4-6	0.5
L	South Pit Wall	10-8-87	8-10	1.0
L	East Pit Wall	10-2-87	2-4	2.7
L	East Pit Wall	10-8-87	4-6	1.1
L	East Pit Wall	10-8-87	8-10	0.5

NR = No Reading Detected (<0.1 ppm)

TABLE 2

Soil Total Petroleum Hydrocarbons
NCDOT/Old Salisbury Road Site
Winston-Salem, North Carolina
Aquaterra Job #200-87-133

Sample Station	Sample Depth (ft)	Sample Date	Units	Total Petroleum Hydrocarbons
K	8-9	10-5-87	mg/Kg	982
L	5-6	10-5-87	mg/Kg	<0.10
I	10-11	11-12-87	mg/Kg	21.6

Soil Extraction According to EPA Method 3550

Analysis According to EPA Method 8020

Analytical Laboratory: Chemical and Environmental Technology, Inc.
Cary, North Carolina

TABLE 3

Laboratory Results for Total Petroleum Hydrocarbons
Temporary Wells TW-1 and TW-2
NCDOT/Old Salisbury Road Site
Winston-Salem, North Carolina
Aquaterra Job #200-87-123

Sample Station	Sample Date	Units	Total Petroleum Hydrocarbons
TW-1	10-6-87	ug/L	<0.50*
TW-1	10-6-87	ug/L	<0.50*
TW-2	10-15-87	mg/L	<0.10**

*Analytical Laboratory: Industrial and Environmental Analysts, Inc.
Cary, North Carolina

**Analytical Laboratory: Chemical and Environmental Technologies, Inc.
Cary, North Carolina

TABLE 4

Laboratory Results for Base-Neutral Acid Extractable Compounds
Temporary Well (TW-2)
NCDOT/Old Salisbury Road Site
Winston-Salem, North Carolina
Aquaterra Job #200-87-123

Sample Station	Sample Date	Units	Total VOC's
TW-2	10-26-87	ug/L	BQL*

Analysis According to EPA Method 625

Analytical Laboratory: Industrial and Environmental Analysts, Inc.
Cary, North Carolina

*BQL = Below Quantification Limit for All Constituents

TABLE 5

Stockpiled Soil OVA Readings
NCDOT/Old Salisbury Road Site
Winston-Salem, North Carolina
Aquaterra Job #200-87-123

Stockpile	Sample Station	Date	OVA Reading (ppm)
1	A	10-2-87	17.0
1	B	10-2-87	10.0
2	A	10-2-87	7.8
2	B	10-2-87	3.6
2	C	10-2-87	0.6
3	A	10-2-87	1.1
4	A	10-26-87	19.0
4	B	10-26-87	4.1
4	C	10-26-87	0.9
4	D	10-26-87	4.3
4	E	10-26-87	4.3
4	F	10-26-87	5.4
4	G	10-26-87	5.7
4	H	10-26-87	4.3
4	I	10-26-87	10.0
4	J	10-26-87	3.4
4	K	10-26-87	6.6
4	L	10-26-87	2.7
4	M	10-26-87	6.8
4	N	10-26-87	9.2

TABLE 6

Stockpiled Soil Total Petroleum Hydrocarbons
NCDOT/Old Salisbury Road Site
Winston-Salem, North Carolina
Aquaterra Job #200-87-123

Stockpile	Sample Station(s)	Sample Date	Units	Total Petroleum Hydrocarbons
4	C-N	10-26-87	mg/Kg	86.3
4	A,B,H,I	11-12-87	mg/Kg	1480

Soil Extraction According to EPA Method 3550

Analysis According to EPA Method 8020

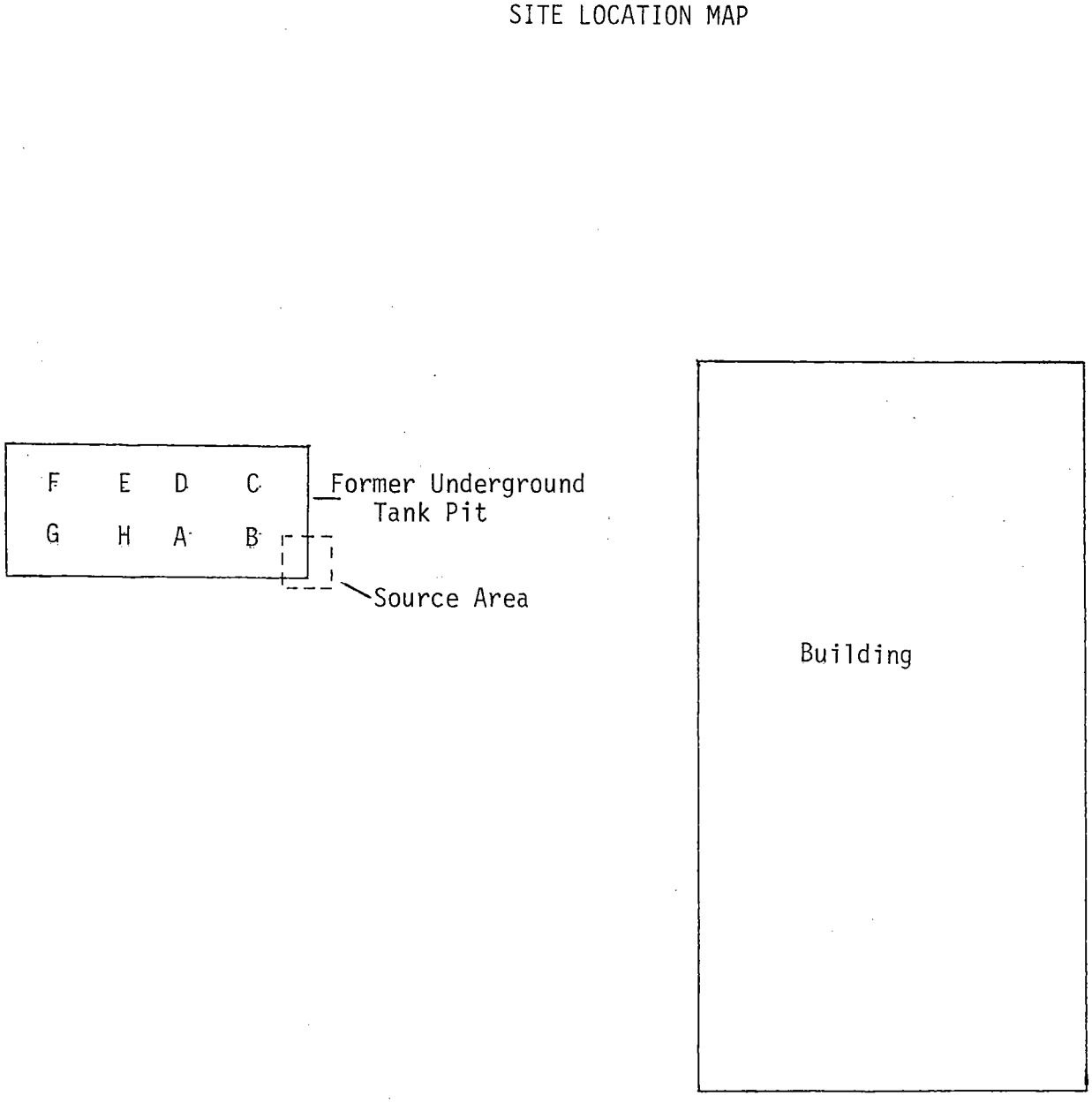
Analytical Laboratory: Chemical and Environmental Technology, Inc.
Cary, North Carolina

FIGURES

PROJECT LOCATION MAP

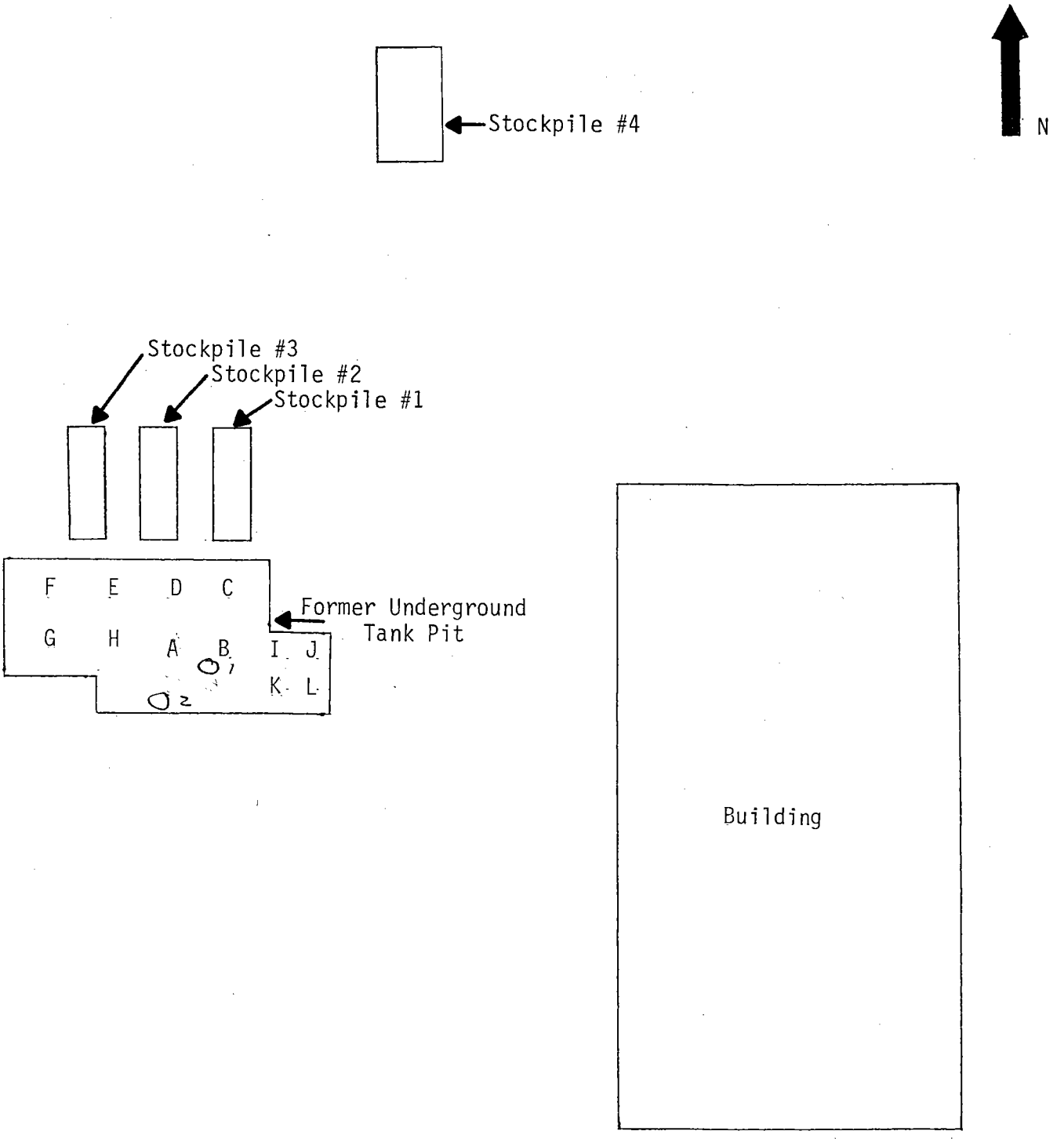
PROJECT	AQUATERRA, INCORPORATED RALEIGH, NORTH CAROLINA	SCALE: N.T.S.
NCDOT Old Salisbury Road Site Winston-Salem		JOB NO: 200-87-123 FIGURE NO: 1

SITE LOCATION MAP



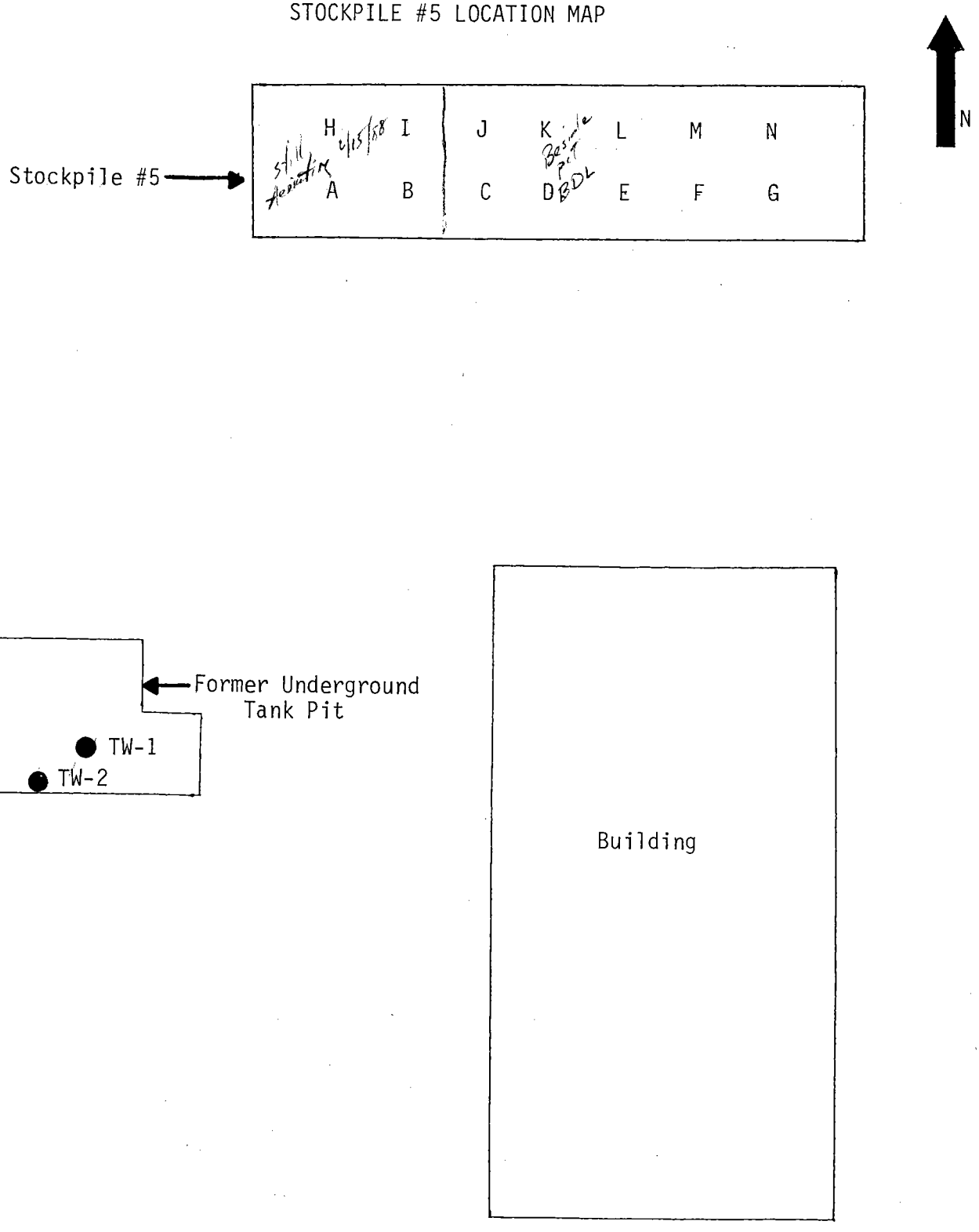
PROJECT	AQUATERRA, INCORPORATED RALEIGH,NORTH CAROLINA	SCALE: 1" = 35'
NCDOT Old Salisbury Road Site Winston-Salem		JOB NO: 200-87-123 FIGURE NO: 2

STOCKPILE LOCATION MAP



PROJECT	AQUATERRA, INCORPORATED	SCALE: 1" = 35'
NCDOT Old Salisbury Road Site Winston-Salem	RALEIGH,NORTH CAROLINA	JOB NO: 200-87-123 FIGURE NO: 3

STOCKPILE #5 LOCATION MAP



PROJECT		
NCDOT Old Salisbury Road Site Winston-Salem	AQUATERRA, INCORPORATED RALEIGH,NORTH CAROLINA	SCALE: 1" = 35' JOB NO: 200-87-123 FIGURE NO: 4

ATTACHMENTS

ATTACHMENT A
SOIL EXCAVATION LOG

ELEVATION FT. MSL	DEPTH FT.	STRATA DESCRIPTION
	0	
		Brown sandy GRAVEL w/some silt (GM), dry, Fill
	1	
		Red-brown f/m/c SAND, little cobbles, clay and silt, (SP), Fill, moist
	3.5	
		Gray CLAY w/some f/sand, (CL), dry
	7.5	
		Light-brown f/m/c SAND w/little mica and silt, (SM), moist
	9.5	
		Brown silty f/m/c SAND, (SC), very moist
	11	

GEOLOGIC INFORMATION	DEPTH(FT.)	LITHOLOGY	STRUCTURE	STRIKE	DIP

REMARKS

TEST PIT:	LOCATION: Old Salisbury Road Winston-Salem, North Carolina	TEST PIT RECORD
DATE COMPLETED: 10/9/87		
JOB NO.: 87-123	LOGGED BY: Patrick Baker	AQUATERRA, INC.
JOB NAME: NCDOT; Old Salisbury Road Site; Winston-Salem; NC		

ATTACHMENT B
NRCD GUIDELINES

GUIDELINES FOR REMEDIAL ACTION CONCERNING CONTAMINATED SOIL AND ROCK MATERIAL REMOVED FROM AREAS OF HYDROCARBON CONTAMINATION

1. All soil and rock material that registers a reading of greater than 10 ppm on a photo ionization meter will be removed and treated (spreading, turning or disking and aeration) until such a time that the material registers a reading of 10 ppm or less on the photo ionization meter.

   OR

   All soil and rock material that registers 100 ppm or greater total hydrocarbons when tested using the attached guidelines will be removed and treated (spreading, turning or disking and aeration) until such a time that the material registers less than 100 ppm total hydrocarbon.

   OR

   In situ treatment of contaminated soils using biodegradation or air purging techniques to achieve contaminant concentrations described above may be considered as an alternative to excavation.

2. When the soil and rock material has reached a reading of 10 ppm and this has been verified by DNRCD personnel, the soil and rock material can then be removed to an approved disposal site. If material is to be moved off site it is recommended that the responsible party contact the North Carolina Department of Human Resources, Solid and Hazardous Waste Management Branch (S & HWMB) (919-733-2178) to ensure compliance with hazardous waste and landfill regulations.

3. A plan of action will be submitted to the Mooresville Office of the DNRCD stating the initial treatment procedure, and the final disposal location of the soil and rock material.

ATTACHMENT C
LABORATORY RESULTS OF FORMER UNDERGROUND TANK PIT SOILS

Chemical & Environmental Technology, Inc.

ENVIRONMENTAL LABORATORY SERVICES

JOHN M. OGLE
PRESIDENT

P. O. BOX 12298
RESEARCH TRIANGLE PARK, N. C. 27709
PHONE (919) 467-3090

Mr. Phil Rahn
Aquaterra, Inc.
P. O. Box 50328
Raleigh, North Carolina 27650

October 8, 1987

Reference: Purchase Order Number 0005(NCDOT-PLR)

SAMPLE HISTORY

CLIENT ID	C & ET SAMPLE	DATE RECEIVED	DATE ANALYZED
K	9835	10/6/87	10/6/87
L	9836	10/6/87	10/6/87 to 10/7/87

ANALYTICAL RESULTS[1]

PARAMETER	METHOD[2]	K	L
Hydrocarbons	3550	982	<0.10

[1]All result units are expressed as mg/kg.

[2]"Test Methods for Solid Wastes," SW-846, July 1982.

[3]Hydrocarbons identified as Fuel Oil No. 6.

CHEMICAL & ENVIRONMENTAL TECHNOLOGY, INC.

Kenneth L. Jesneck
Lab Manager

KLJ/gw

[redacted] DEPT. [redacted]

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
87-123	NCDOT

SAMPLERS: (Signature) Patrick S. Baker

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	REMARKS
K	10/5/87			✓		1	NC State recommended method for total hydrocarbons. Suspect Diesel.
A	10/5/87			✓		1	RUSH
							P.O. NCDOT-PLR

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Patrick S. Baker	10/5/87 16:43				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature) John E. Barr / Gerald Hogue	Date / Time 10/5/87 1720 / 10/5/87 16:45	Remarks P.O.# 0005 Aquaterra, Inc.	

DISTRIBUTION: Original and Pink copies accompany sample shipment to laboratory: Pink copy retained by laboratory: Yellow copy retained by samplers.

5/84

CTE

Chemical & Environmental Technology, Inc.

ENVIRONMENTAL LABORATORY SERVICES

JOHN M. OGLE
PRESIDENT

P. O. BOX 12298
RESEARCH TRIANGLE PARK, N. C. 27709
PHONE (919) 467-3090

Mr. Pat Baker
Aquaterra, Inc.
P. O. Box 50328
Raleigh, North Carolina 27650

November 17, 1987

Reference: Purchase Order Number 87122

SAMPLE HISTORY

CLIENT ID	C & ET SAMPLE	DATE RECEIVED	DATE ANALYZED
ABHI-Comp.	10515	11/12/87	11/14/87
I	10516	11/12/87	11/14/87

ANALYTICAL RESULTS[1]

PARAMETER	METHOD[2]	ABHI-Comp.	I
Total Petroleum Hydrocarbons[3]	****	1480	21.6

[1]All result units are expressed as mg/kg.

[2]"Guidelines for Addressing Fuel Leaks," California Water Quality Control Board, September 1985.

[3]Identified as Diesel Fuel.

CHEMICAL & ENVIRONMENTAL TECHNOLOGY, INC.

Kenneth L. Jesneck/JHH

Kenneth L. Jesneck
Lab Manager

KLJ/gw

[redacted]AQUA[redacted]RA, [redacted]

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
87122	NCDOT - W-5

SAMPLERS: (Signature) Patrick S. Baker

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CON-TAINERS	Total Petrol Hydrocarbons						REMARKS
ABII E	11/12/87	09:55	✓			1	1						
I	"	10:15		✓	Depth of 10-11'	1	1						
													RUSH
													48 hr turnaround

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Patrick S. Baker	11/12/87 16:49				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	
		G. H. Pretzberger	11-12-87 1650	P.O. # 0019	

DISTRIBUTION: Original and Pink copies accompany sample shipment to laboratory; Pink copy retained by laboratory; Yellow copy retained by samplers.

ATTACHMENT D
LABORATORY RESULTS OF GROUND WATER SAMPLES

Industrial & Environmental Analysts, Inc.
P.O. Box 12846 • Research Triangle Park, NC 27709 • 919-467-9919

Date: October 13, 1987

Mr. Patrick Baker
Aqua-Terra Resource Technologies
419 Boylan Ave.
Raleigh, NC 27650

Reference: IEA Report No. 196031

Dear Mr. Baker,

Transmitted herewith are the results of analyses on two samples submitted to our laboratory on October 9, 1987.
Please see the enclosed reports for your results.

Very truly yours,

INDUSTRIAL & ENVIRONMENTAL ANALYSTS, INC.

Frederick T. Doane
Senior Scientist

IEA LAB RESULTS

IEA# 196031 Samples: 2 Total Parameters: 2

Client Name Aqua-Terra Resource Technologies

Sa#	Sample I.D.	Parameter Studied	Results	Date Analyzed	Comments
1	TW-1	Petroleum Hydrocarbons by GC	<50 µg/L	10/9/87	
2	TW-2	Petroleum Hydrocarbons by GC	<50 µg/L	10/9/87	

Chemical & Environmental Technology, Inc.

ENVIRONMENTAL LABORATORY SERVICES

JOHN M. OGLE
PRESIDENT

P. O. BOX 12298
RESEARCH TRIANGLE PARK, N. C. 27709
PHONE (919) 467-3090

Mr. Pat Baker
Aquaterra, Inc.
P. O. Box 50328
Raleigh, North Carolina 27650

October 19, 1987

Reference: Purchase Order Number 0008

SAMPLE HISTORY

CLIENT ID	C & ET SAMPLE	DATE RECEIVED	DATE ANALYZED
TW-2	10066	10/16/87	10/19/87

ANALYTICAL RESULTS[1]

PARAMETER	METHOD[2]	TW-2
Total Petroleum Hydrocarbons	****	<0.01

[1]All result units are expressed in mg/L.

[2]NC Method for Total Petroleum Hydrocarbons.

CHEMICAL & ENVIRONMENTAL TECHNOLOGY, INC.

Kenneth L. Jesneck
Lab Manager

KLJ/gw

[redacted] DEPT. [redacted]

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
	NCDOT : W/S

SAMPLERS: (Signature)
Patrick S. Baker

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	Total Hydrocarbons Suspect Diesel	REMARKS
TW-2	10/15/87	10:30		✓		2		Because of silt in water I have collected 1 liter of sample. Please Decant 500 ml of usable sample. RUSH

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Patrick S. Baker	10/15/87 17:20				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	
		[signature]	10/15/87 1735	P.O. # 0008 For: Aquaterra, Inc	

DISTRIBUTION: Original and Pink copies accompany sample shipment to laboratory: Pink copy retained by laboratory: Yellow copy retained by samplers.

5/84

Industrial & Environmental Analysts, Inc.
P.O. Box 12846 • Research Triangle Park, NC 27709 • 919-467-9919

Date: November 3, 1987

Mr. Patrick Baker
Aqua-Terra Resource Technologies
P.O. Box 50328
Raleigh, NC 27650

Reference: IEA Report No. 196039

Dear Mr. Baker,

Transmitted herewith are the results of analyses on one sample submitted to our laboratory on October 27, 1987.
Please see the enclosed reports for your results.

Very truly yours,

INDUSTRIAL & ENVIRONMENTAL ANALYSTS, INC.

Frederick T. Doane
Senior Scientist

Comments: BQL - BELOW QUANTITATION LIMIT

IEA Sample No. 196039 1 **Sample Identification** TW-2

Date Extracted October 30, 1987 **Date Analyzed** October 30, 1987

By Olszewski

GC/MS Base/Neutral Extractables

Number	Compound	Quantitation Limit ug/L	Concentration ug/L
1	ACENAPHTHENE	20	BQL
2	ACENAPHTHYLENE	20	BQL
3	ANTHRACENE	20	BQL
4	BENZIDINE	20	BQL
5	BENZO (a) ANTHRACENE	20	BQL
6	BENZO (a) PYRENE	20	BQL
7	BENZO (b) FLUORANTHENE	20	BQL
8	BENZO (ghi) PERYLENE	20	BQL
9	BENZO (k) FLUORANTHENE	20	BQL
10	BIS (2-CHLOROETHOXY) METHANE	20	BQL
11	BIS (2-CHLOROETHYL) ETHER	20	BQL
12	BIS (2-CHLOROISOPROPYL) ETHER	20	BQL
13	BIS (2-ETHYLHEXYL) PHTHALATE	20	57
14	4-BROMOPHENYL PHENYL ETHER	20	BQL
15	BENZYL BUTYL PHTHALATE	20	BQL
16	2-CHLORONAPHTHALENE	20	BQL
17	4-CHLOROPHENYL PHENYL ETHER	20	BQL
18	CHRYSENE	20	BQL
19	DIBENZO (a,h) ANTHRACENE	20	BQL
20	1,2-DICHLOROBENZENE	20	BQL
21	1,3-DICHLOROBENZENE	20	BQL
22	1,4-DICHLOROBENZENE	20	BQL
23	3,3'-DICHLOROBENZIDINE	20	BQL
24	DIETHYL PHTHALATE	20	BQL
25	DIMETHYL PHTHALATE	20	BQL
26	DI-N-BUTYL PHTHALATE	20	BQL
27	2,4-DINITROTOLUENE	20	BQL
28	2,6-DINITROTOLUENE	20	BQL
29	DI-N-OCTYLPHTHALATE	20	30
30	FLUORANTHENE	20	BQL
31	FLUORENE	20	BQL
32	HEXACHLOROBENZENE	20	BQL
33	HEXACHLOROBUTADIENE	20	BQL
34	HEXACHLOROCYCLOPENTADIENE	20	BQL
35	HEXACHLOROETHANE	20	BQL
36	INDENO (1,2,3-cd) PYRENE	20	BQL
37	ISOPHORONE	20	BQL
38	NAPHTHALENE	20	BQL
39	NITROBENZENE	20	BQL
40	N-NITROSODIMETHYLAMINE	20	BQL
41	N-NITROSO-DI-N-PROPYLAMINE	20	BQL
42	N-NITROSODIPHENYLAMINE	20	BQL
43	PHENANTHRENE	20	BQL
44	PYRENE	20	BQL
45	1,2,4-TRICHLOROBENZENE	20	BQL

Comments: BQL - BELOW QUANTITATION LIMIT

GC/MS Acid Extractables

IEA Sample No. 196039 1
Sample Identification TW-2
Date Extracted October 30, 1987 **Date Analyzed** October 30, 1987
By Olszewski

Number	Compound	Quantitation Limit ug/L	Results Concentration ug/L
1	4-CHLORO-3-METHYLPHENOL	20	BQL
2	2-CHLOROPHENOL	20	BQL
3	2,4-DICHLOROPHENOL	20	BQL
4	2,4-DIMETHYLPHENOL	20	BQL
5	2,4-DINITROPHENOL	100	BQL
6	2-METHYL-4,6-DINITROPHENOL	100	BQL
7	2-NITROPHENOL	20	BQL
8	4-NITROPHENOL	100	BQL
9	PENTACHLOROPHENOL	100	BQL
10	PHENOL	20	BQL
11	2,4,6-TRICHLOROPHENOL	20	BQL

Comments | BQL - BELOW QUANTITATION LIMIT

GC/MS PCB/Pesticides

IEA Sample No. 196039 1
Sample Identification TW-2
Date Extracted October 30, 1987 **Date Analyzed** October 30, 1987
By Olszewski

Number	Compound	Quantitation Limit	Results Concentration
		ug/L	ug/L
1	ALDRIN	0.1	BQL
2	Alpha - BHC	0.1	BQL
3	Beta - BHC	0.1	BQL
4	Delta - BHC	0.1	BQL
5	Gamma - BHC	0.1	BQL
6	CHLORDANE	0.2	BQL
7	4,4'-DDD	0.2	BQL
8	4,4'-DDE	0.2	BQL
9	4,4'-DDT	0.2	BQL
10	DIELDRIN	0.2	BQL
11	ENDOSULFAN I	0.2	BQL
12	ENDOSULFAN II	0.2	BQL
13	ENDODULFAN SULFATE	0.2	BQL
14	ENDRIN	0.2	BQL
15	ENDRIN ALDEHYDE	0.2	BQL
16	HEPTACHLOR	0.2	BQL
17	HEPTACHLOR EPOXIDE	0.2	BQL
18	TOXAPHENE	2.0	BQL
19	PCB 1016	2.0	BQL
20	PCB 1221	2.0	BQL
21	PCB 1232	2.0	BQL
22	PCB 1242	2.0	BQL
23	PCB 1248	2.0	BQL
24	PCB 1254	2.0	BQL
25	PCB 1260	2.0	BQL

DEPT.

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
	N.D.T

SAMPLERS: (Signature) Patrick S. Bike

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS							REMARKS
TW-2	11/18/87	13:45		✓	E	2							
													1. Report analysis 625
													2. Want 1 week turnaround

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Patrick S. Bike	11/18/87 17:55				

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
		Lesa L. Juang	10/26 6:00	Fr: Aquatec, Inc P.O. ...14

DISTRIBUTION: Original and Pink copies accompany sample shipment to laboratory; Pink copy retained by laboratory; Yellow copy retained by samplers.

5/84

ATTACHMENT E
LABORATORY RESULTS OF STOCKPILED SOILS

CTE

Chemical & Environmental Technology, Inc.

ENVIRONMENTAL LABORATORY SERVICES

JOHN M. OGLE
PRESIDENT

P. O. BOX 12298
RESEARCH TRIANGLE PARK, N. C. 27709
PHONE (919) 467-3090

Mr. Pat Baker
Aquaterra, Inc.
P. O. Box 50328
Raleigh, North Carolina 27650

November 13, 1987

Reference: Purchase Order Number Verbal (NCDOT)

SAMPLE HISTORY

CLIENT ID	C & ET SAMPLE	DATE RECEIVED	DATE ANALYZED
C-N	10235	10/27/87	11/6/87 to 11/11/87

ANALYTICAL RESULTS[1]

PARAMETER	METHOD[2]	C-N
Total Petroleum Hydrocarbons[3]	****	86.3

[1]All result units are expressed as mg/kg.

[2]"Guidelines for Addressing Fuel Leaks," California Water Quality Control Board, September 1985.

[3]Hydrocarbons identified as Fuel Oil No. 2.

CHEMICAL & ENVIRONMENTAL TECHNOLOGY, INC.

Kenneth L. Jasneck
Lab Manager

KLJ/gw

PT.

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
	NCDOT

SAMPLERS: (Signature)
Patrick 3. Baker

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	REMARKS
L-N	10/26/87	14:40	✓			1	
							Total Hydrocarbons
							Jet Fuel Diesel

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Patrick 3. Baker	10/26/87 14:40				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	
			10/26/87 1740	Aquaterra	

DISTRIBUTION: Original and Pink copies accompany sample shipment to laboratory: Pink copy retained by laboratory: Yellow copy retained by samplers.

5/84

Chemical & Environmental Technology, Inc.

ENVIRONMENTAL LABORATORY SERVICES

JOHN M. OGLE
PRESIDENT

P. O. BOX 12298
RESEARCH TRIANGLE PARK, N. C. 27709
PHONE (919) 467-3090

Mr. Pat Baker
Aquaterra, Inc.
P. O. Box 50328
Raleigh, North Carolina 27650

November 17, 1987

Reference: Purchase Order Number 87122

SAMPLE HISTORY

CLIENT ID	C & ET SAMPLE	DATE RECEIVED	DATE ANALYZED
ABHI-Comp.	10515	11/12/87	11/14/87
I	10516	11/12/87	11/14/87

ANALYTICAL RESULTS[1]

PARAMETER	METHOD[2]	ABHI-Comp.	I
Total Petroleum Hydrocarbons[3]	****	1480	21.6

[1]All result units are expressed as mg/kg.

[2]"Guidelines for Addressing Fuel Leaks," California Water Quality Control Board, September 1985.

[3]Identified as Diesel Fuel.

CHEMICAL & ENVIRONMENTAL TECHNOLOGY, INC.

Kenneth L. Jesneck/JHS

Kenneth L. Jesneck
Lab Manager

KLJ/gw

AQUATERRA, INC.

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
87122	NCDOT - W-5

SAMPLERS: (Signature) Patrick S. Baker

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	Total Petroleum Hydrocarbons							REMARKS
A.B.H.I	11/9/87	09:55	✓			1								
I	"	10:15		✓	Depth of 10-11'	1	1							RUSH 48 hr turnaround

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Patrick S. Baker	11/12/87 16:47				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	
		D. H. Ritzenberger	11-12-87 1650	P.O. # 0019	

DISTRIBUTION: Original and Pink copies accompany sample shipment to laboratory: Pink copy retained by laboratory: Yellow copy retained by samplers.